

48. A method of producing biochips comprising the steps of:
arranging a plurality of capillaries having bottom open ends disposed at predetermined spacings so that said bottom open ends are kept apart at all times from and adjacent to and above a planar substrate so as to form a plurality of gaps between said plurality of capillaries and said substrate so that no current flows therebetween, said bottom open ends having diameters of dimensions which provide solution surface tension greater than gravitational force thereby to prevent biomolecules from dropping down through said bottom open ends to said substrate by force of gravity during a non-depositing condition;

providing said biomolecules in said plurality of capillaries;
providing polymerase chain reaction to cause amplification of said biomolecules contained within said plurality of capillaries;

applying a voltage across each of said plurality of capillaries and said substrate in its entirety during a depositing condition so that said plurality of capillaries and said substrate in its entirety are oppositely charged to cause electrostatic attractive forces to be engaged between said biomolecules and said substrate before said biomolecules come into contact with said substrate and to allow by force of attraction a very small volume of said biomolecules to move downward and swell out through said bottom open ends of said plurality of capillaries to be deposited concurrently on a plurality of sites on said substrate at spacings similar to said predetermined spacings of said plurality of capillaries; and

stopping applying said voltage during said non-depositing condition so that said biomolecules are held within said plurality of capillaries by surface tension at said bottom open ends which is greater than said gravitational force, whereby

accurate efficient control of said voltage applying causes uniform and reliable concurrent deposits of a plurality of droplets of said biomolecules and fixing thereof in fixed positions on said substrate when said biomolecules make contact with said substrate.

49. The method of claim 48, wherein said polymerase chain reaction is performed by atmospheric temperature change or by heating ^(with) laser irradiation.

50. The method of claim 48, wherein said biomolecules are swelled out from said bottom open ends of said plurality of capillaries as droplets of picoliter size and deposited onto said substrate.

51. An apparatus for producing biochips comprising:

a plurality of capillaries having bottom open ends disposed at predetermined spacings so that said bottom open ends are kept apart at all times from and adjacent to and above a planar substrate so as to form a plurality of gaps between said plurality of capillaries and said substrate so that no current flows therebetween, said bottom open ends having diameters of dimensions which provide solution surface tension greater than gravitational force thereby to prevent biomolecules from dropping down through said bottom open ends to said substrate by force of gravity during a non-depositing state;

means for providing said biomolecules to said plurality of capillaries;

amplifying means for providing polymerase chain reaction to cause amplification of said biomolecules contained within said plurality of capillaries;

adjusting means for adjusting said gaps between said bottom open ends of said plurality of capillaries and said planar substrate by moving either said plurality of capillaries or said planar substrate, or both;

transfer means for transferring said biomolecules from said plurality of capillaries to sites on said planar substrate during a depositing state, and for enabling said biomolecules to remain in said plurality of capillaries during said non-depositing state, said transfer means comprising:

voltage means for applying a voltage across each of said plurality of capillaries and said substrate in its entirety during said depositing state so that said plurality of capillaries and said substrate in its entirety are oppositely charged to cause electrostatic attractive forces to be engaged between said biomolecules and said substrate before said biomolecules come into contact with said substrate and to allow by force of attraction a very small volume of said biomolecules to move downward and swell out through said bottom open ends of said plurality of capillaries to be deposited concurrently on a plurality of said sites on said substrate at spacings similar to said predetermined spacings of said plurality of capillaries; and

means for stopping applying of said voltage during said non-depositing state so that said biomolecules are held within said plurality of capillaries by surface tension at said bottom open ends which is greater than said gravitational force, whereby

accurate efficient control of said voltage means and said means for stopping applying causes uniform and reliable concurrent deposits of a plurality of droplets of said biomolecules and fixing thereof in fixed positions on said substrate when said biomolecules make contact with said substrate.

52. The apparatus of claim 51, wherein said amplifying means comprises means for providing said polymerase chain reaction by temperature processing.

53. The apparatus of claim 51, wherein said voltage means comprises means for causing said biomolecules to be swelled out from said bottom open ends of said plurality of capillaries as droplets of picoliter size and deposited onto said substrate.
